AMENDMENTS TO THE CLAIMS

A detailed listing of all claims that are, or were, in the present application, irrespective of whether the claim(s) remains under examination in the application are presented below. The claims are presented in ascending order and each includes one status identifier. Those claims not cancelled or withdrawn but amended by the current amendment utilize the following notations for amendment: 1. deleted matter is shown by strikethrough; and 2. added matter is shown by underlining.

1. (Currently Amended) A photonic crystal waveguide ~~including~~ comprising:

a core formed of a photonic crystal having periodicity in [[one]] a first direction and ~~which propagates~~ propagating an electromagnetic wave in a second direction perpendicular to the [[one]] first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band thereon comprising a propagation mode in which the electromagnetic wave is propagated ~~the photonic crystal being characterized in that:~~

~~the electromagnetic wave is propagated by a propagation mode of a photonic band present on a Brillouin zone boundary in a photonic band structure of the core~~; ~~and~~

a homogeneous medium cladding having a refractive index n_s; and

the core further comprising a side face ~~of the core~~ parallel to the [[one]] first direction, ~~is~~ the side face in contact with ~~a~~ the homogeneous medium cladding ~~having a refractive index n_s~~, the side face satisfying the condition:

$$\lambda_0/n_s > a\lambda/(\lambda^2/4+a^2)^{0.5}$$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes [[the]] a period of the photonic crystal, and λ denotes [[the]] a period of the wave propagated through the core in [[a]] the second direction perpendicular to the [[one]] first direction.

2. (Currently Amended) The photonic crystal waveguide according to claim 1, ~~characterized in that~~ further comprising a confinement cladding~~, which is~~ formed of at least one of a homogeneous material or a photonic crystal having periodicity in at least the [[one]] first direction~~, is~~ and arranged on a surface of the core perpendicular to the [[one]] first direction to prevent the electromagnetic wave propagated through the core from leaking out of the surface.

3. (Currently Amended) The photonic crystal waveguide according to claim 1 ~~or 2~~, ~~characterized in that~~ wherein [[the]] a width 2L of the core in a direction perpendicular to [[the]] a longitudinal direction of the waveguide is in a range of:

$$s\lambda/2\cos\phi_0 \leq 2L < (s+1)\lambda/2\cos\phi_0$$

when [[the]] a propagation angle ϕ of the electromagnetic wave satisfying::

$$\lambda_0/n_s - a(\lambda/\cos\phi)/\{(\lambda/2\cos\phi)^2+a^2\}^{0.5}=0$$

is in the range of $0<\phi<90°$, the value in ~~this~~ the range [[is]] defined as [[the]] a maximum value ϕ_0 of propagation angles at which the electromagnetic wave is confined by the side face, and [[the]] a phase shift amount is $s\pi$ when the wave propagated through the core is reflected by the side face at the maximum value ϕ_0 of the propagation angle, and s is in a range of $0 \leq s \leq 1$.

4. (Currently Amended) The photonic crystal waveguide according to claim 1 ~~or 2~~, ~~characterized in that when the~~ wherein a phase shift amount is $s\pi$ when the wave propagated through the core in [[a]] the second direction perpendicular to the [[one]] first direction is perpendicularly incident on the side face and reflected thereby, s is in the range $0 \leq s \leq 1$, and the conditions:

$\lambda_0/n_s-2a>0$ and

$s\lambda/2 \leq 2L$

are satisfied.

5. (Currently Amended) The photonic crystal waveguide according to claim 4, ~~characterized in that the~~ wherein a width 2L of the core in a direction perpendicular [[to the]] a longitudinal direction of the waveguide is in a range of:

$s\lambda/2 \leq 2L<(s+1)\lambda/2$.

6. (Currently Amended) The photonic crystal waveguide according to ~~any one of~~ claim[[s]] 1 ~~to 5~~, ~~characterized in that~~ further comprising a confinement cladding layer~~, which is~~ formed of a photonic crystal having periodicity in at least the [[one]] first direction and formed of the same materials as the core, ~~is~~ arranged on a surface of the core, and wherein a photonic bandgap is formed by the confinement cladding layer in the [[one]] first direction ~~confines the~~ confining the propagation mode in the [[one]] first direction of the core, while making radiation modes ~~close~~ similar to the propagation mode ~~as radiation modes~~.

7. (Currently Amended) The photonic crystal waveguide according to ~~any one of~~ claim[[s]] 1 ~~to 6~~, ~~characterized by~~ further comprising a phase modulating device on an end face of the core, such that ~~where the~~ a periodic structure thereof is exposed, the phase modulating device operable for coupling the wave propagated through the core to an external plane wave.

8. (Currently Amended) The photonic crystal waveguide according to claim 7, ~~characterized in that~~ wherein when n denotes a refractive index of an external medium and λ_0 denotes a wavelength of an external plane wave in a vacuum, the phase modulating device [[uses]] using the end face of the core parallel to the [[one]] first direction as an external coupling face, [[and]] such that the phase modulating device couples, in the coupling face, plane waves having an incident angle θ in the [[one]] first direction ~~that is~~ represented by the formula:

$$n \cdot \sin\theta \cdot (a/\lambda_0) = 0.5$$

to the end face.

9. (Currently Amended) The photonic crystal waveguide according to claim 7, ~~characterized in that,~~ wherein when n denotes a refractive index of an external medium and λ_0 denotes a wavelength of an external plane wave in a vacuum, the phase modulating device [[uses]] using the end face of the core parallel to the [[one]] first direction as an external coupling face, and, in the coupling face, causes two planes having the same phase and having incident angles $\pm\theta$ in the [[one]] first direction ~~that is~~ represented by the formula:

$$n \cdot \sin\theta \cdot (a/\lambda_0) = 0.5$$

to interfere with each other to couple them to the end face.

10. (Currently Amended) The photonic crystal waveguide according to claim 7, ~~characterized in that:~~ wherein

the phase modulating device is a phase grating arranged ~~close to, in contact with, or integrally with~~ proximate an incident surface, which is an end face of the core parallel to the one direction, and has a period in the same direction as the photonic crystal forming the core that is twice the period of the photonic crystal; and

the phase grating couples the external plane wave to the electromagnetic wave propagated through the core.

11. (Currently Amended) The photonic crystal waveguide according to claim 7, ~~characterized in that~~ wherein the phase modulating device is a phase grating arranged ~~close to, in contact with, or integrally with~~ proximate the [[an]] end face of the core parallel to the [[one]] first direction, and has the same period in the same direction as the photonic crystal forming the core; and

[[the]] at least one of an incident angle or exit angle θ of an external plane wave coupled to the electromagnetic wave ~~(propagated light)~~ propagated through the core by the phase grating satisfies the formula:

$$n \cdot \sin\theta \cdot (a/\lambda_0)=0.5$$

where n denotes a refractive index of an external medium, and λ_0 denotes a wavelength of the external plane wave in vacuum.

12. (Currently Amended) The photonic crystal waveguide according to claim 7, ~~characterized in that~~ wherein the phase modulating device is a phase grating arranged ~~close to, in contact with, or integrally with~~ proximate the [[an]] end face of the core parallel to the [[one]] first direction, and has a period in the same direction as the photonic crystal forming the core that is twice the period of the photonic crystal; and

[[the]] an incident angle or exit angle θ of the external plane wave coupled to the wave ~~(propagated light)~~ propagated through the core by the phase grating satisfies the formula:

$$n \cdot \sin\theta \cdot (a/\lambda_0) = 0.5$$

where n denotes a refractive index of an external medium, and λ_0 denotes a wavelength of the external plane wave in a vacuum.

13. (Currently Amended) The photonic crystal waveguide according to claim 7, ~~characterized in that~~ wherein the core comprises a slant end face inclined with respect to the first direction and the phase modulating device directly couples the external plane wave to ~~an~~ the slant end face of the core ~~that is inclined with respect to the one direction~~.

14. (Currently Amended) The photonic crystal waveguide according to claim 13, ~~characterized in that~~ further comprising at least one of one of a prism or mirror ~~is~~ arranged ~~in contact with or close to~~ proximate the slant end face of the core to change [[the]] an incoming direction or an outgoing direction of the external plane wave.

15. (Currently Amended) The photonic crystal waveguide according to claim 14, ~~characterized in that~~ wherein the incoming direction or outgoing direction of the external plane wave is matched with [[the]] a propagation direction in the core formed by the photonic crystal.

16. (Currently Amended) The photonic crystal waveguide according to claim 14, ~~characterized in that~~ wherein the incoming direction or outgoing direction of the external plane wave is perpendicular to [[the]] a propagation direction in the core formed by the photonic crystal.

17. (Currently Amended) The photonic crystal waveguide according to claim 14, ~~characterized in that~~ comprising a [[the]] prism having [[has]] a refractive index of 3 or more.

18. (Currently Amended) The photonic crystal waveguide according to claim 14, ~~characterized by~~ further comprising ~~a slant end face of the core, which is inclined with respect to the one direction, and~~ a diffraction grating ~~that is~~ arranged ~~close to, in contact with, or integrally with~~ proximate the slant end face.

19. (Currently Amended) The photonic crystal waveguide according to claim 18, ~~characterized in that~~ wherein the incoming direction or the outgoing direction of the external plane wave coupled to the wave propagated through the core by the diffraction grating is matched with [[the]] a propagation direction in the core formed of the photonic crystal.

20. (Currently Amended) The photonic crystal waveguide according to ~~any one of~~ claim[[s]] 1 ~~to 19~~, ~~characterized in that the~~ wherein a width of the core ~~in a direction~~ perpendicular to [[the]] a longitudinal direction of the waveguide is ~~varied in a~~ tapered ~~manner~~ .

21. (Currently Amended) A photonic crystal waveguide ~~including~~ comprising:

a core formed of a photonic crystal having periodicity in [[one]] a first direction ~~which propagates~~ and propagating an electromagnetic wave in a second direction perpendicular to the [[one]] first direction, the core comprising a photonic band structure having a Brillouin zone center line and a high-order photonic band thereon comprising a propagation mode in which the electromagnetic wave is propagated ~~the photonic crystal characterized in that:~~

~~the electromagnetic wave is propagated by a propagation mode of a high-order photonic band present on the Brillouin zone center line in the photonic band structure of the core; and~~

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face ~~of the core~~ parallel to the [[one]] first direction ~~is~~ in contact with ~~a~~ the homogeneous medium cladding ~~having refractive index n_s~~, the side face satisfying the condition:

$$\lambda_0/n_s-\lambda>0$$

where λ_0 denotes a wavelength of the electromagnetic wave in vacuum, a denotes [[the]] a period of the photonic crystal, and λ denotes [[the]] a period of the wave propagated through the core in [[a]] the second direction perpendicular to the [[one]] first direction.

22. (Currently Amended) The photonic crystal waveguide according to claim 21, ~~characterized in that~~ further comprising a confinement cladding, ~~which is~~ formed at least one of a homogeneous material or a photonic crystal having periodicity in [[the]] at least [[one]] the first direction, ~~is~~ and arranged on a surface of the core perpendicular to the [[one]] first direction for preventing the electromagnetic wave propagated through the core from leaking out of the surface.

23. (Currently Amended) The photonic crystal waveguide according to claim 21 ~~or 22~~, ~~characterized in that the~~ wherein width 2L of the core in a direction perpendicular to a [[the]] longitudinal direction of the waveguide is in a range of:

$s\lambda/2\cos\phi_0 \leq 2L < (s+1)\lambda/2\cos\phi_0$

with [[the]] a propagation angle ϕ of the electromagnetic wave satisfying:

$\lambda_0/n_s - \lambda/\cos\phi = 0$

and being in a range of $0 < \phi < 90°$, with a value in this range being defined as a maximum value ϕ_0 of propagation angles at which the electromagnetic wave is confined by the side face; and

[[the]] wherein a phase shift amount is $s\pi$ when the wave propagated through the core is reflected by the side face at the maximum value ϕ_0 of the propagation angle, and s being in the range $0 \leq s \leq 1$.

24. (Currently Amended) The photonic crystal waveguide according to ~~any one of~~ claim[[s]] 21 ~~to 23~~, ~~characterized in that~~ further comprising

a confinement cladding layer, which is formed of a photonic crystal having a periodicity in at least the [[one]] first direction, [[and]] is formed of the same materials as the core~~, is~~ and is arranged on a surface of the core, and

a photonic bandgap formed by the confinement cladding layer ~~confines~~ confining the propagation mode in the [[one]] first direction of the core, while making [[the]] radiation modes similar [[close]] to the propagation mode ~~as a radiation modes~~.

25. (Currently Amended) The photonic crystal waveguide according to ~~any one of~~ claim[[s]] 21 ~~to 24~~, ~~characterized by~~ further comprising:

a phase modulating device on an end face of the core where [[the]] a periodic structure thereof is exposed, the phase modulating device operable for coupling the electromagnetic wave propagated through the core to [[the]] an external plane wave.

26. (Currently Amended) The photonic crystal waveguide according to claim 25, ~~characterized in that~~ wherein when n denotes a refractive index of an external medium and λ_0 denotes a wavelength of the external plane wave in a vacuum, the phase modulating device [[uses]] using the end face of the core parallel to the [[one]] first direction as an external coupling face, and, in the coupling face, causes two plane waves having the same phase and having an incident angle $\pm\theta$ in the [[one]] first direction that is represented by the formula:

$$n \cdot \sin\theta \cdot (a/\lambda_0) = 1.0$$

to interfere with each other to couple them to the end face.

27. (Currently Amended) The photonic crystal waveguide according to claim 25, ~~characterized in that~~ wherein when n denotes a refractive index of an external medium, and λ_0 denotes a wavelength of the external plane wave in a vacuum, the phase modulating device [[uses]] using the end face of the core parallel to the [[one]] first direction as an external coupling face, and, in the coupling face, causes two plane waves having the same phase and having an incident angle $\pm\theta$ in the [[one]] first direction that is represented by the formula:

$$n \cdot \sin\theta \cdot (a/\lambda_0) = 1.0$$

and the plane wave with $\theta=0$ to interfere simultaneously to couple them to the end face.

28. (Currently Amended) The photonic crystal waveguide according to claim 25, ~~characterized in that~~ wherein:

the phase modulating device is a phase grating arranged ~~close to, in contact with, or integrally with~~ proximate an incident surface~~, which is an end face of the core parallel to the one direction~~, and has [[the]] a same period in [[the]] a same direction as the photonic crystal forming the core; and

the phase grating couples the external plane wave to the electromagnetic wave propagated through the core.

29. (Currently Amended) The photonic crystal waveguide according to ~~any one of~~ claim[[s]] 21 ~~to 28~~, ~~characterized in that~~ wherein a [[the]] width of the core ~~in a direction~~ perpendicular to [[the]] a longitudinal direction of the waveguide is ~~varied in a~~ tapered ~~manner~~.

30. (Currently Amended) A homogeneous medium waveguide ~~including~~ comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in [[one]] a first direction and propagating ~~which propagates~~ the electromagnetic wave in a second direction perpendicular to the [[one]] first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction ~~the homogeneous medium waveguide being characterized in that:~~

~~the electromagnetic wave is propagated by a first-order or higher-order propagation mode in the one direction of the core~~; ~~and~~

a homogeneous medium cladding having a refractive index n_s in which [[a]] the side face of the core parallel to the [[one]] first direction is in contact with [[a]] the homogeneous medium cladding ~~having refractive index n_s~~, the side face satisfying the condition:

$n_s<n_0$.

31. (Currently Amended) The homogeneous medium waveguide according to claim 30, ~~characterized in that~~ further comprising a confinement cladding~~, which is~~ formed of at least one of a homogeneous material or a photonic crystal having a periodicity in at least the [[one]] first direction, ~~is~~ arranged on a surface of the core perpendicular to the [[one]] first direction to prevent the electromagnetic wave propagated through the core from leaking out of the surface.

32. (Currently Amended) The homogeneous medium waveguide according to claim 30 ~~or 31~~, ~~characterized in that the~~ wherein a width 2L of the core in [[the]] a longitudinal direction of the waveguide is in a range of:

$s\lambda_0\cos\psi/2\sin\phi_0 \leq 2L<(s+1)\lambda_0\cos\psi/2\sin\phi_0$

with [[the]] a propagation angle ϕ of the electromagnetic wave satisfying:

$n_s-n_0\{\sin^2\psi+\cos^2\psi\cos^2\phi\}^{0.5}=0$

and being in a range of $0<\phi<90°$, the value in this range being defined as a maximum value ϕ_0 of propagation angles at which the electromagnetic wave is confined by the side face, and

[[the]] a phase shift amount is $s\pi$ when the wave propagated through the core is reflected by the side face at the maximum value ϕ_0 of the propagation angle, and s being in a range of $0 \leq s \leq 1$.

33. (Currently Amended) The homogeneous medium waveguide according to claim 30 ~~or 31~~, ~~characterized in that~~ wherein when [[the]] a phase shift amount is $s\pi$ and the wave propagated through the core in a direction ~~(XZ plane direction)~~ perpendicular to the [[one]] first direction is perpendicularly incident on the side face and reflected thereby, s is in a range of $0 \leq s \leq 1$, and the conditions:

$n_s-n_0\sin\psi<0$ and

$s\lambda_0\cos\psi/2 \leq 2L$

are satisfied.

34. (Currently Amended) The homogeneous medium waveguide according to claim 33, ~~characterized in that the~~ wherein a width 2L of the core is in a range of:

$s\lambda_0\cos\psi/2 \leq 2L<(s+1)\lambda_0\cos\psi/2$.

35. (Currently Amended) The homogeneous medium waveguide according to ~~any one of~~ claim[[s]] 30 ~~to 34~~, ~~characterized in that~~ wherein an external plane wave having an incident angle θ in the [[one]] first direction is represented by the formula:

$$\sin\theta=(n_0/n_m)\sin\psi$$

where n_0 denotes a refractive index of the core, n_m denotes a refractive index of the incident light side, and ψ denotes a propagation angle of high-order mode light propagated through the core, is coupled to an end face of the core parallel to the [[one]] first direction, such [[so]] that the external plane wave is used as incident light or outgoing light.

36. (Currently Amended) The homogeneous medium waveguide according to claim[[s]] 30 ~~to 34~~, ~~characterized in that the~~ wherein an external plane wave is coupled to a slant end face of the core that is inclined with respect to the [[one]] first direction, and the external plane wave has an incident angle for coupling to [[the]] a high-order mode of [[the]] a propagation angle ψ in the [[one]] first direction, such [[so]] that the external plane wave is used as incident light or outgoing light.

37. (Currently Amended) The homogeneous medium waveguide according to ~~any one of~~ claim[[s]] 30 ~~to 34~~, ~~characterized in that~~ wherein the core comprises a slant end face inclined with respect to the first direction, the homogeneous medium waveguide further comprising at least one of a prism or mirror ~~is~~ arranged proximate ~~in contact with or close to~~ the slant end face ~~of the core that is inclined with respect to the one direction~~ to couple high-order

mode light in the [[one]] first direction propagated through the core to [[the]] an external plane wave so that the external plane wave is used as incident light or outgoing light.

38. (Currently Amended) The homogeneous medium waveguide according to claim 37, ~~characterized in that the~~ wherein an incoming direction or an outgoing direction of the external plane wave is matched with [[the]] a propagation direction in the waveguide.

39. (Currently Amended) The homogeneous medium waveguide according to claim 37, ~~characterized in that the~~ wherein an incoming direction or an outgoing direction of the external plane wave is perpendicular to [[the]] a propagation direction in the waveguide.

40. (Currently Amended) The homogeneous medium waveguide according to claim 37, ~~characterized in that~~ comprising a [[the]] prism having [[has]] a refractive index of 3 or more.

41. (Currently Amended) The homogeneous medium waveguide according to ~~any one of~~ claim[[s]] 30 ~~to 34~~, ~~characterized in that~~ wherein the core comprises a slant end face inclined with respect to the first direction, the homogeneous medium waveguide further comprising a diffraction grating ~~is~~ arranged ~~close to, in contact with, or integrally with~~ proximate the slant end face of the core ~~that is inclined with respect to the one direction~~.

42. (Currently Amended) The homogeneous medium waveguide according to claim 41, ~~characterized in that the~~ wherein an incoming direction or an outgoing direction of the external plane wave is matched with [[the]] a propagation direction in the waveguide.

43. (Currently Amended) The homogeneous medium waveguide according to ~~any one of~~ claim[[s]] 30 ~~to 34~~, ~~characterized in that~~ wherein the core comprises an end face parallel to the first direction, the homogeneous medium waveguide further comprising a phase grating ~~is provided close to, in contact with, or integrally with an~~ proximate the end face of the core that is parallel to the [[one]] first direction, and diffraction light of the external plane wave by the phase grating is coupled to high-order mode light propagated through the core in the [[one]] first direction, such [[so]] that the plane wave is used as incident light or outgoing light.

44. (Currently Amended) The homogeneous medium waveguide according to ~~any one of~~ claim[[s]] 30 ~~to 43~~, ~~characterized in that the~~ wherein a width of the core in a direction perpendicular to [[the]] a longitudinal direction of the waveguide is ~~varied in a~~ tapered ~~manner~~.

45. (Currently Amended) An optical device for use as a directional coupler, the optical device ~~including~~ comprising two waveguides formed to be bent ~~close to each~~ proximate each other in a coupling region having a predetermined coupling length, ~~the optical device being characterized in that:~~ in which

each of the two waveguides is formed ~~by the~~ of a photonic crystal waveguide ~~according to any one of claims 1 to 29 or the homogeneous medium waveguide according to any one of claims 30 to 44~~, with each photonic crystal waveguide comprising:

a core formed of a photonic crystal having periodicity in a first direction and which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$$\lambda_0/n_s>a\lambda/(\lambda^2/4+a^2)^{0.5}$$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction.

46. (Currently Amended) An optical device for use as a Mach Zehnder optical switch, the optical device ~~including~~ comprising a first single linear waveguide, two branched waveguides branched from the first single linear waveguide, and a second single linear waveguide formed by merging the two branched waveguides, ~~the optical device being characterized in that:~~ in which

each of the waveguides is formed by ~~the~~ a photonic crystal waveguide ~~according to any one of claims 1 to 29 or the homogeneous medium waveguide according to any one of claims 30 to 44~~ comprising:

a core formed of a photonic crystal having periodicity in a first direction and which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$\lambda_0/n_s>a\lambda/(\lambda^2/4+a^2)^{0.5}$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction.

47. (Currently Amended) An optical device for use as an optical delay line, the optical device ~~including~~ comprising a linear waveguide and a single waveguide~~, which has~~ having a delay portion, ~~the optical device being characterized in that:~~ wherein

each of the waveguides and the delay portion are formed ~~by the~~ of a photonic crystal waveguide ~~according to any one of claims 1 to 29 or the homogeneous medium waveguide according to any one of claims 30 to 44~~ comprising:

a core formed of a photonic crystal having periodicity in a first direction and which propagates electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$\lambda_0/n_s>a\lambda/(\lambda^2/4+a^2)^{0.5}$

where λ_0 denotes wavelength of the electromagnetic wave in a vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction.

48. (Currently Amended) An optical device for use as a dispersion control device, the optical device ~~including~~ comprising a waveguide formed ~~by the~~ of a photonic crystal waveguide comprising ~~according to any one of claims 1 to 29 or the homogeneous medium waveguide according to any one of claims 30 to 44, the optical device being characterized in that~~:

a core formed of a photonic crystal having periodicity in a first direction and which propagates electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$\lambda_0/n_s>a\lambda/(\lambda^2/4+a^2)^{0.5}$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction, wherein

propagated light having a large dispersion condition is ~~used as propagated light~~ propagated through the waveguide.

49. (Currently Amended) An optical device ~~being characterized by~~ comprising:

a ~~waveguide formed by the~~ photonic crystal waveguide comprising:

a core formed of a photonic crystal having periodicity in a first direction and which propagates electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$\lambda_0/n_s>a\lambda/(\lambda^2/4+a^2)^{0.5}$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes the period of a photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction ~~according to any one of claims 1 to 29 or the homogeneous medium waveguide according to any one of claims 30 to 44~~, the core ~~containing~~ comprising a material having nonlinear characteristics; and

the waveguide comprising two surfaces and the optical device further comprising two electrodes arranged on the two surfaces of the waveguide in the first [[one]] direction.

50. (Currently Amended) [[An]] the optical device ~~being characterized by~~ of claim 49, further comprising

~~a waveguide formed by the~~ a photonic crystal waveguide ~~according to any one of claims 1 to 29 or the homogeneous medium waveguide according to any one of claims 30 to 44, the core containing a material having nonlinear characteristics;~~

~~two electrodes arranged on two surfaces of the waveguide in the one direction; and~~

a modulator for changing a voltage or an electric current applied to the two electrodes.

51. (Currently Amended) An optical device ~~being characterized by~~ comprising:

~~the~~ a photonic crystal waveguide comprising:

a core formed of a photonic crystal having periodicity in a first direction and which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band

present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$\lambda_0/n_s>a\lambda/(\lambda^2/4+a^2)^{0.5}$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction ~~according to any one of claims 1 to 29 or the homogeneous medium waveguide according to any one of claims 30 to 44~~, wherein the cladding is confined ~~confinement of the cladding is made~~ imperfectly to generate refracted light from the core.

Please add new claims 52-58 as follows:

52. (New) An optical device for use as a directional coupler, the optical device comprising:

two waveguides formed to be bent proximate each other in a coupling region having a predetermined coupling length, in which each of the waveguides is formed of a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction

perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$.

53. (New) An optical device for use as a Mach Zehnder optical switch, the optical device comprising:

a first single linear waveguide, two branch waveguides branched from the first single linear waveguide, and a second single linear waveguide formed by merging the two branch waveguides, wherein each of the waveguides are formed of a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$.

54. (New) An optical device for use as an optical delay line, the optical device comprising:

a linear waveguide and a single waveguide having a delay portion, each of the waveguides and the delay portion formed of a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$.

55. (New) An optical device for use as a dispersion control device, the optical device comprising a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$,

wherein the propagated light comprises a large dispersion condition.

56. (New) An optical device comprising:

a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a first direction propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$,

the core comprising a material having nonlinear characteristics; and

two electrodes arranged on two surfaces of the waveguide in the first direction.

57. (New) An optical device being comprising:

a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$,

the core comprising a material having nonlinear characteristics;

the waveguide further comprising:

two surfaces, wherein two electrodes are arranged on the two surfaces of the waveguide in the first direction; and

a modulator for changing a voltage or an electric current applied to the two electrodes.

58. (New) An optical device comprising:

a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction, the core propagating an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$,

wherein the cladding is imperfectly confined to generate refracted light from the core.